Wastewater Treatment and Its Management of Endocrine-Disrupting Chemicals

Marc Mills
Environmental Engineer
U.S. EPA Office of Research and Development (ORD)/National Risk Management Research Laboratory (NRMRL)
(513) 569-7322
mills.marc@epa.gov

Authors: Marc A. Mills, Gregory Sayles, Paul McCauley, Richard Brenner, Eric Kleiner
U.S. EPA ORD/NRMRL
Keywords: endocrine-disrupting chemicals, EDC, wastewater treatment, risk management, effluent

Research has shown that wastewater treatment (WWT) can be a significant source of endocrine-disrupting chemicals (EDCs) to the environment. WWT can include centralized wastewater treatment plants (WWTPs) or on-site WWT technologies. EDCs found in WWT effluents (aqueous and biosolids) include estrogenic and androgenic hormones, detergent metabolites, and plasticizers. Many questions exist as to why some WWT technologies have higher or lower removal efficiencies. Little research has been conducted to demonstrate how technology or plant operations contribute to EDC removal. The efficacy of the unit processes within the plant is not well characterized. In addition, no significant research has been conducted to evaluate on-site WWT for the management of EDCs.

One focus of the EDC and wastewater research is to characterize the performance of existing risk management strategies. This research has been started at the bench and pilot scale. Research has been conducted on the fate of alkylphenols and to characterize their biodegradation rates under redox conditions typically found in WWTPs. Additionally, research is being initiated to evaluate estrogenic and androgenic hormones under similar conditions.

At the pilot scale, two pilot plants were constructed and operated to simulate a municipal WWTP. The plants were fed a simulated wastewater with constant dosing of EDCs to allow a mass balance analysis of the plant and the individual unit processes. Research has also been initiated at the full plant scale. A project evaluating the digesters' efficacy has been initiated to study alkylphenols, hormones, and bisphenol A. This project is a collaborative effort between the ORD laboratories, Region 5, and a regional wastewater utility.

A second focus of this research is to determine techniques to optimize existing management strategies or develop alternative management strategies. Once unit operations and technology performance are understood, engineering solutions can be developed to reduce EDC discharge. Additional research is being developed in the areas of on-site WWT technologies. These technologies include septic systems, constructed wetlands, and other on-site technologies.

The results of this research can be used to help WWT operators understand the capability of their plants to remove EDCs, how process variables influence performance, and how to improve the operation of their plants to minimize effluent levels of EDCs. In the future, if the U.S.

Environmental Protection Agency (U.S. EPA) concludes that EDCs in effluents must be regulated, the Office of Water will require performance information on conventional and innovative treatment to make regulatory determinations.